

Respirator Fit Testing

**For Firefighters
In Massachusetts**



**Executive Office of Labor
and Workforce Development
Department of Labor Standards**



What is Respirator Fit Testing?

A respirator fit test is done to check that the mask size and model chosen fits the face. Although a respirator may look like it fits correctly, gaps can occur around the nose, chin or eyes. A fit test confirms that the mask fits properly and that there is minimal air leakage between the face and the mask. A **fit test** is different from the **fit check** or **user seal check**. A **fit check** should be done each time you don the mask to check to see that the properly fitted mask is adequately tightened and seated on your face.

Why Fit Test?

In the past it was thought that positive pressure SCBAs did not need to be fit tested because any leakage of air would cause clean air to leave the mask and would prevent contaminated air from entering. However, recent studies have shown that the air supply can be overbreathed, especially at the high work rates that occur during firefighting. This may lead to inward leakage of contaminants, a situation that can be potentially life threatening to firefighters. An additional concern for firefighters is that a poorly fitted mask can also lead to excessive outward leakage, thereby decreasing the life of the air supply.

What Standards Require Fit Testing?

The new OSHA Respirator Standard (1910.134), effective 1998, requires fit testing of all respirators including those with positive pressure. In addition, NFPA 1500, Fire Department Occupational Health and Safety, and NFPA 1404, Fire Department SCBA Program, state that respirators should be fit tested. Both NFPA and OSHA state that fit testing should be done annually.

More than half the states in the US cover their public sector workers, such as firefighters, with OSHA standards or equivalent. In Massachusetts, although public sector workers are not specifically covered by OSHA, the Massachusetts Department of Labor Standards (DLS) can set standards for municipal worker occupational health under MGL Chapter 149 section 6. It is the policy of the Department of Labor Standards that in order to meet the intent of Chapter 149 section 6, municipalities should comply with OSHA standards such as the Respirator Standard.

In addition, according to Massachusetts General Law Chapter 48 Section 51A, breathing apparatus must meet NFPA standards set for SCBAs. (According to legal counsel at the State Fire Academy, this would include the requirement for fit testing respirators.)

Types of Fit Testing

During fit testing, the firefighter should wear all gear that may interfere with the fit of the respirator. This usually includes the helmet, fire hood and turnout coat as a minimum. Some departments have chosen to have firefighters wear all turnout gear during fit testing.

There are two types of fit testing that can be done on positive pressure respirators;

- Qualitative
- Quantitative.

A brief description of each type of fit test follows. The pros and cons of each type are summarized in Table 1.

Qualitative Fit Testing

Qualitative Fit testing is a pass/fail test that relies on the respirator user to indicate when he/she can smell, taste, or sense the test agent. The OSHA standard allows the use of four fit test protocols using the test agents :

- Bitrex ,
- Saccharin,
- Isoamyl acetate or
- Irritant smoke.

In order to perform the test, the respirator must be detached from the air supply and converted to a negative pressure respirator using either an organic vapor or particulate filter, depending on the test agent chosen. Many masks can be easily converted to negative pressure by disconnecting from the air supply and by attaching the appropriate filter or cartridge.

The respirator user is first tested with a low concentration of the test agent to insure that he/she can sense the agent. This is done without wearing the respirator. If, for example, saccharin is used, the respirator user must be able to taste the saccharin aerosol generated. If the test agent cannot be detected then another agent must be selected. Once the proper test agent is selected, the respirator user dons the respirator and places a fit test hood over the head. A more concentrated test solution is then aerosolized inside the hood. The user does seven, one minute "exercises" such as turning the head from side to side and touching toes. Each exercise is done for one minute. The aerosol bulb is squeezed a number of times by the fit tester throughout the test in order to maintain a high concentration of the aerosol inside the hood.

A properly fitted mask will only allow air to pass through the filters and will not allow the contaminant to "leak" into the mask. If at the end of the test exercises the respirator user does not detect the test agent, then the respirator fits properly and the fit test is passed. If not, and the user detects the agent, then the test fails, and the user must select another size or brand mask. Easy to follow, step by step instructions for each of the four qualitative fit test protocols are given in Appendix A of the OSHA standard.

Table 1 Pros and Cons of Fit Test Types

Qualitative	Quantitative
Cheaper up front cost	More expensive up front cost
Requires less technical equipment	Requires more technical equipment
Relies on users sense of taste or smell	Get numerical measure of leakage
Could “fake” results or inadvertently pass or fail the test	Cannot fake results

Quantitative Fit Testing

Quantitative fit testing provides a numerical measure of leakage. It does not rely on the firefighter’s sense of taste or smell. There are currently two commercially available quantitative fit test instruments. Both require the use of either a fit test mask or a sample adapter in order to do the fit testing. Both methods are approved OSHA methods.

The **TSI Portacount** measures the ambient particle concentration outside and inside the mask and compares the two values to determine the amount of leakage into the mask. The **OHD Fit Tester 3000** provides a direct measure of leakage by creating a negative pressure inside the mask and measuring the pressure difference inside and outside the mask.

Like the qualitative fit test, the quantitative fit test requires the user to perform “exercises” while the test is ongoing. At the end of the test, an average fit factor is calculated. The fit test is passed if the result is 500 or greater. Quantitative fit test machines can be used in conjunction with a computer program that can store and maintain the results of the fit test.

Other Considerations

A recent study published in Fire International showed that almost half of a group of firefighters tested showed a significant loss of smell. Most of those who had lost some sense of smell did not know it prior to the testing. Since taste and smell are associated, and since **qualitative fit testing** relies on response to taste and smell, it is unclear if this would have an impact on the results. Theoretically, the prescreening done during qualitative fit testing should eliminate this potential problem by revealing the ability or inability to taste or smell the test agent.

The fit test hoods used for most **qualitative** fit testing may, in some cases, not be large enough to comfortably enclose the firefighter when wearing the helmet. It may be best to purchase a fit test tent that is larger than the fit test hood typically used for qualitative fit testing.

The National Institute of Occupational Safety and Health (NIOSH) does not recommend the use of irritant smoke for **qualitative** fit testing due to the irritating effects of the hydrochloric acid that is generated. However, there are many who prefer this type of fit test since it involves an involuntary

response and does not rely on the ability to taste or smell the test agent. In addition, no hood or tent is used for the irritant smoke protocol, thereby eliminating the problem of fitting into a fit test hood or tent.

NIOSH recommends the use of **quantitative fit testing** for firefighters since it allows a more objective selection of mask size.

Cost may be a significant factor in making the decision on which type of fit test to do. A **qualitative fit** test kit typically ranges in price from less than \$100 up to several hundred dollars. There is a wide range in the number of persons that can be fit tested with a particular kit. Some kits can only test 25 persons, while others can test several hundred individuals with a single kit. This puts the cost range from as little as \$0.30/person up to \$5.00/person or more.

The cost of the quantitative fit test machine ranges from about \$6000 to \$7000. This includes the cost of software which can be used in conjunction with a computer to store the data. Some fire departments have joined together and have pooled resources in order to purchase the fit test equipment. The equipment is then shared amongst Departments. For example, Barnstable County, purchased a quantitative fit test machine through their county government and have done fit testing throughout the county.

Who Can Do Fit Testing?

Fit testing may be done by a knowledgeable person within the local Fire Department or it may be done by an outside contractor. Some respirator sales companies may provide the initial fit test free of charge or may charge a nominal fee. There are some companies who will provide fit testing on a per person basis. Costs typically range from \$25 to \$50 for a quantitative fit test. Costs for qualitative fit testing are usually less and often depend on the number of individuals tested.

Fit Testing is relatively simple to perform. Protocols are written up in the OSHA standard step by step making it easy for almost anyone knowledgeable about respirators to perform.

Technical assistance is available from several sources including OSHA, the Mass Department of Labor Standards and respirator manufacturers.

Further Information on Respiratory Protection and Fit Testing

There are other requirements in the OSHA respirator standard and in NFPA standards that include requirements for medical screening prior to respirator use and the development of a written respirator program. **The Massachusetts Department of Labor Standards (DLS)** has bulletins on medical screening for respirator use, as well as a model written respirator program for fire departments available on request. The DLS can also provide either telephone or on site technical assistance. Forms for obtaining further information are attached.

In addition, the Massachusetts Department of Labor Standards has a website with information on public sector worker health and safety as well as information on other issues that may impact municipal workers such as indoor air quality and Right to Know. Informational brochures are listed at the end of the Indoor Air Quality page. (www.state.ma.us/dols).

The OSHA website (www.osha.gov) provides valuable information on setting up respiratory protection programs. The "Small Entity Compliance Guide for Respiratory Protection" provides easy to read information on setting up a respirator

program that complies with the OSHA standard. It includes a sample written respirator program. The National Institute of Occupational Safety and Health website (www.cdc.gov/niosh) not only includes information on respiratory protection, but also provides information on firefighter health and safety in general

In conclusion

There are many types and sizes of masks available on the market. It is unlikely that a firefighter would be unable to find a properly fitting mask.

Firefighters must be confident that their respirator works and fits properly. A daily inspection and preventative maintenance program ensures that the equipment works properly. An annual fit test insures that each firefighter is wearing a mask that provides the maximum protection against leakage.

Each fire department needs to weigh the pros and cons of each type of fit test in order to make a decision on which type to do. However, one thing is agreed upon by all those involved in respiratory protection. **Any** type of fit test is preferable to **no** fit test.

Materials Available in Print or CD

Please photocopy this page and send to:

Massachusetts Department of Labor Standards, Workplace Safety and Health Program
1001 Watertown Street, 2nd Floor, West Newton, MA 02465 Or fax to 617-244-2705

Model Written Respirator Program for Fire Departments

☐ Hard copy ☐ CD

OSHA Appendix B-Fit Testing Procedures

☐ Hard copy ☐ CD

Medical Screening for Respirator Use

☐ Hard copy ☐ CD

Please contact me to set up a consultative visit at my facility

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